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SYMBIOTIC ZOANTHIDS (ANTHOZOA: CNIDARIA) OF PUERTO RICO

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ABSTRACT

The symbiotic zoanthids of Puerto Rico are examined histologically and anatomically. The four known West Indian species, *Parazoanthus tunicans*, *P. swiftii*, *P. parasiticus*, and *P. catenularis*, and two new species, *P. puertoricense* and *Epizoanthus cutressi*, are described. The relationships between growth of zoanthid colonies with growth of their host sponges is examined, and other ecological notes are presented.

Zoanthidea of the genus *Parazoanthus* are colonial symbionts, primarily of sponges but in some cases of hydroids and octocorals. The 22 known species of *Parazoanthus* are, for the most part, tropical. All occur subtidally, but none are known from depths greater than 100 m. Due to their relatively deep habitat on coral reefs (usually below 10 m), these animals had not lent themselves to extensive observation and collection until the advent of SCUBA. Because the earliest specimens were collected with dredge and trawl, the retracted condition of the polyps caused by such rough handling was considered their natural state (Haddon and Shackleton, 1891; Duerden, 1898a). Thus, the literature discussing *Parazoanthus* has dealt almost exclusively with the taxonomy of preserved specimens in the retracted state and from only a few localities. Little is mentioned about species variability, host specificity, bathymetric range, and other biological aspects.

Zoanthidea of the genus *Epizoanthus* are primarily colonial symbionts, but also occur free living and as solitary polyps. Of the three known species of *Epizoanthus* which are symbionts of sponges, only one, *E. sabulosum* Cutress (1971), from Australia, is found in shallow water. For *Epizoanthus*, as for *Parazoanthus*, most publications are faunal reports and disclose few aspects of the biology and ecology of species in this genus.

In the waters off the southwestern coast of Puerto Rico, sponge-dwelling zoanthids, particularly *Parazoanthus*, are abundant and easily collected. The specimens of *Parazoanthus* and *Epizoanthus* herein described are from material collected in these waters. In addition to the four described species of *Parazoanthus* known from the West Indies, one new species was found. All previously reported associations with sponges were observed in Puerto Rico and, in addition, several new host sponges were found. Also, a new species of *Epizoanthus* on a sponge was collected and is described here. Since specimens could be collected and maintained alive, it was possible to carry out laboratory investigations on certain aspects of their biology and toxicity (West, 1976) and also to anesthetize and fix specimens in the expanded condition, enabling more accurate histological and morphological examination than was possible for earlier investigators. Furthermore, the ability of *in situ* observation enabled the documentation, over an extended period, of growth and some interspecific interactions.

Since the original descriptions of the four known species are superficial, incomplete, and based on specimens in poor condition, these species are redescribed here. Also, two new species are described and additional ecological and biological notes are included for all species discussed.

MATERIALS AND METHODS

Collection and Maintenance of Specimens.—Except for *Parazoanthus swiftii* and *P. parasiticus*, which were common on the inner reefs, collections of specimens had to be made from an area near the edge of the insular shelf in water 20–50 m deep, approximately 10 km south of La Parguera, Puerto Rico. All collecting was accomplished with the use of SCUBA equipment. Specimens were transported to the laboratory in aerated sea water. Specimens for observation, photography, and experimentation were maintained in various sizes of aquaria and polyethylene trays with running seawater in the Department of Marine Sciences, University of Puerto Rico, laboratory at La Parguera. Preserved specimens were deposited in the Department of Marine Sciences museum; holotypes of new species were deposited in the U.S. National Museum.

Preparation of Specimens for Histological Examination.—The optimum condition of full polyp expansion was obtained by relaxing specimens before fixation using the anesthetic agents of either an emulsion of 5% propylene phenoxetol or a solution of $MgCl_2$ isotonic to seawater. Anesthetization was done in liter finger bowls by adding 10 ml of phenoxetol emulsion or by slowly replacing seawater with the $MgCl_2$ solution. When the polyps failed to respond to tactile stimuli, they were fixed in 10% formalin.

The anatomy of specimens was investigated from stained sections and temporary squash preparations. Tissues were decalcified with 5% HCl and in some cases desilicified with 15% HF in order to rid them of infiltrated particles which often tear the tissues during sectioning. The polyps were embedded in paraffin, sectioned, mounted, and stained with Harris' hematoxylin and eosin. Classification and measuring of nematocysts was accomplished with squash preparations of pieces of fresh or fixed tissue dissected from parts of the zoanthid polyps.

Field Observations.—Documentation of field observations was usually done photographically. The five species which live on sponges were observed over a period of 14 weeks to investigate their growth in relation to the growth of their host sponges. Six permanent stations were established and marked with 18 mm iron stakes at one location near the edge of the insular shelf, 20–30 m deep. A different species of host sponge was represented at each station. Five of the sponge species were hosts each to a single zoanthid species; in two cases one species of zoanthid was represented on two sponge species of different growth forms, and the sixth sponge species had two different zoanthid species living together on it. Each station was photographed bi-weekly, permitting a serial record of eight photographs which were compared and examined for increase in sponge tissue and change of zoanthid colony size and form.

SYSTEMATICS

Family Parazoanthidae Delage and Hérouard, 1901: 665

Zoanthidea with the primitive pairs of mesenteries consisting solely of macrocnemes; marginal sphincter muscle entodermal.

Parazoanthus Haddon and Shackleton, 1891: 653

Type-species.—*Palythoa axinellae* Schmidt, 1862: 61–62, pl. 6, figs. 2–3, by original designation. Gender neuter.

Diagnosis.—Parazoanthidae with diffuse marginal sphincter muscle in the entoderm; scapus and coenenchyme incrusted with foreign material; ectoderm always continuous; mesogloea with encircling sinus as well as ectodermal canals, lacunae, and cell islets. Polyps usually colonial and connected by band-like or incrusting coenenchyme. (Diagnosis is essentially that of Haddon and Shackleton, 1891.)

Number of Species.—Five species of *Parazoanthus* were found in the coastal waters of Puerto Rico. All but *Parazoanthus tunicans*, which lives on a hydroid, are symbionts of sponges. Only principal references to the species are given. For further references, see Walsh (1967).

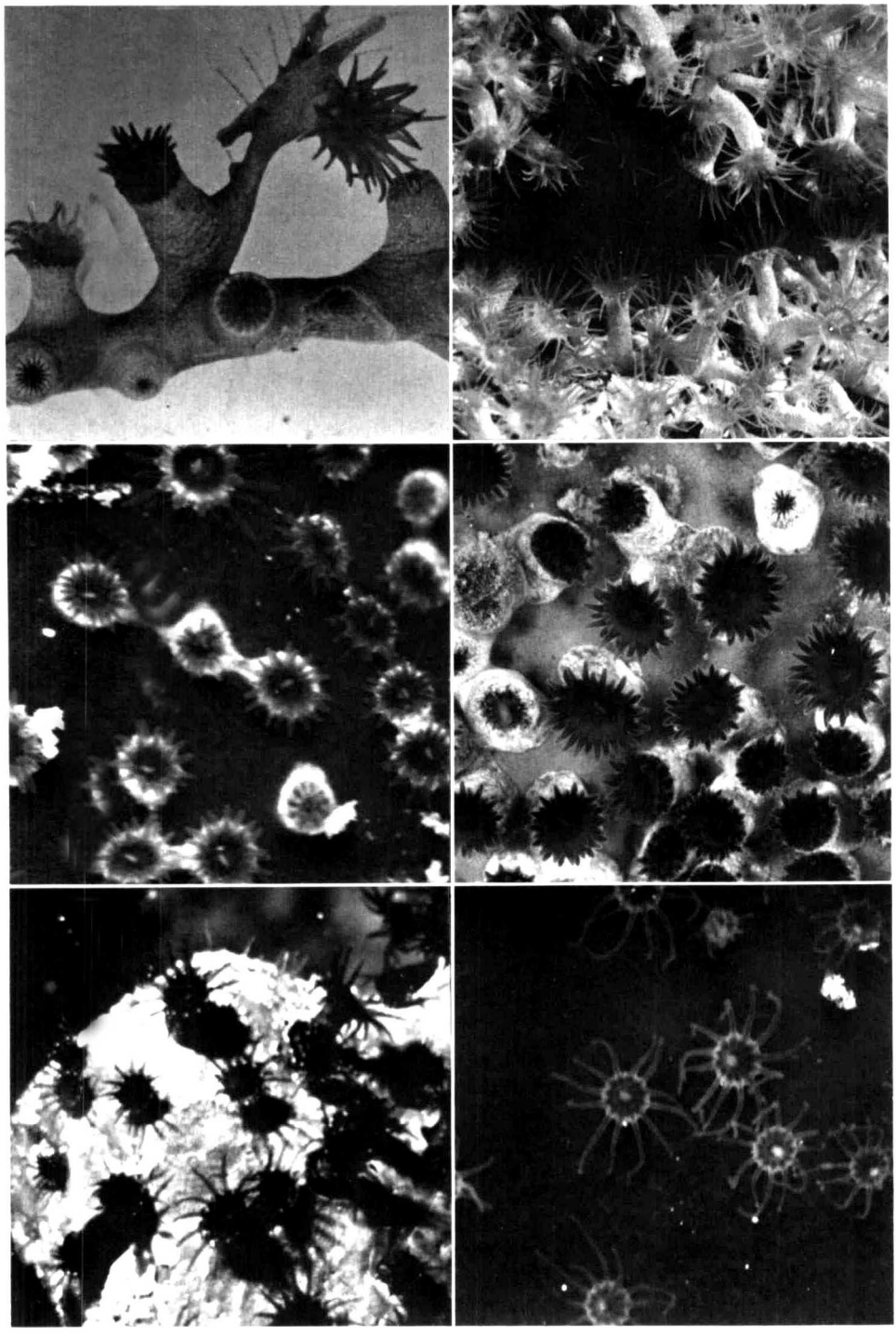

Figure 1. Upper left, *Parazoanthus tunicans* on *Plumularia* sp. (×4); upper right, *P. swiftii* on *Iotrochota birotulata* (×1.5); middle left, *P. catenularis* on *Xestospongia* sp. (×10); middle right, *P. parasiticus* on Spheciospongia sp. (×7); bottom left, *P. puertoricense* on *Agelas* sp. (×3); bottom right, *Epizoanthus cutressi* on *Xestospongia* sp. (×20).

Parazoanthus tunicans Duerden
Figures 1 and 2

Parazoanthus tunicans Duerden, 1900: 193–197, pl. 10, fig. 11; pl. 13, fig. 7; pl. 15, figs. 4–5.

Material.—One colony of over 200 polyps on *Plumularia* sp. collected at 20 m on the edge of the insular shelf off La Parguera, Puerto Rico, by the author, December 1970.

Diagnosis.—Colony enveloping stems of a large species of *Plumularia*; extended living polyps, 10 × 3 mm; coenenchyme thin and incrusting; scapus thick-walled, its ectoderm and mesogloea densely infiltrated with white calcareous sand; scapulus thin-walled, clean; scapular ridges numbering to 18, distinct; tentacles and mesenteries numbering to 36; marginal sphincter muscle entodermal, weak, and diffuse; mesogloea of column and mesenteries thick, with extensive encircling sinus, numerous cell islets and lacunae; holotrichs of column ectoderm and mesenterial entoderm abundant; coenenchyme and column white, due to infiltrated sand grains; tentacles brown.

Description.—Length and diameter of largest fully extended living polyps, respectively, 10 mm and 3 mm; other polyps in extended, preserved condition 3–4 mm long and 2–2.5 mm in diameter; fully retracted polyps mammiform and less than a millimeter in length; colony covering almost all axial stems and branches of 10 cm hydroid colony, leaving only an occasional row of pinnate secondary branches exposed.

Due to density of white sand grains, color of column cream-white; tentacles and oral disc brown due to pigment granules in entoderm; insertions of macrocnemes visible through oral disc in some living specimens.

Incrusting coenenchyme thin, sheetlike, more or less covering hydroid skeleton completely as it advances; polyps arranged in approximately distichous manner on thinner hydroid branches, either opposite or alternate, their distribution more irregular on the thicker stems; average interpolyp distance 1–2 polyp diameters.

Scapus thick-walled and densely infiltrated with fine white calcareous sand; scapulus much shorter, thin-walled, bearing up to 18 distinct ridges, and free of infiltrated particles except for portions of ridges adjacent to scapus; oral disc up to 1.5 mm in diameter, concave and bearing at its center protruding mouth with prominent siphonoglyph.

Marginal sphincter muscle (Fig. 2b) entodermal, weak, and diffuse; muscle fibers borne on approximately 12 low, branched mesogloeal pleats; mesogloea in region of sphincter densely packed with sponge spicules which impart considerable rigidity to margin.

Mesenteries number to 36 in largest specimens, 20 macrocnemic and 16 microcnemic; retractor muscles of macrocnemes barely discernible, consisting of fine sheath of fibers against mesogloea; mesenterial filaments ciliated, typically trifoliate close to actinopharynx, but more cylindrical below, containing few basophilic gland cells on two lateral ciliated tracts; entoderm of mesenteries thin, containing mostly pigmented cells filled with brown granules but also a few large holotrichs; mesogloea of macrocnemes very thin except for portion nearest column where it thickens and contains numerous islets of acidophilic gland cells; microcnemes, which extend out from column approximately one-third as far as macrocnemes, resemble thickened portion of macrocnemes (Fig. 2a). All specimens sectioned lacked discernible gonads.

Actinopharynx smooth, possessing ectoderm with numerous nematocysts, few acidophilic gland cells, and very few granular pigment cells; siphonoglyph well developed, extending beyond end of actinopharynx; hyposulcus indistinct and

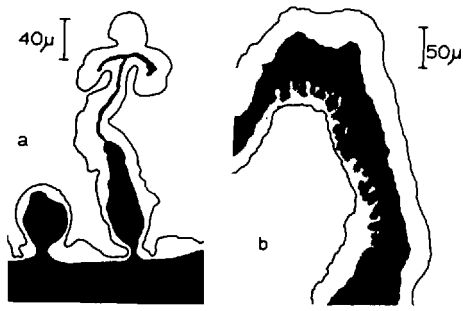

Figure 2. *Parazoanthus tunicans*: a, transverse section of a macro- and microcneme; b, transverse section of the scapular region showing the pleats of the mesogloea (black) on which the sphincter muscle fibers are borne.

slightly shorter than siphonoglyph; in cross section, mesogloea of actinopharynx very thin, thickening in region of siphonoglyph and its juncture with directive mesenteries; entoderm of actinopharynx with pigment cells and a few acidophilic and basophilic gland cells.

Mesogloea of column acellular and nonfibrous; of scapus, with numerous lacunae left by dissolved calcareous sand grains; encircling sinus present close to entoderm and lined with cells similar to ectoderm and a few nematocysts; islets of acidophilic gland cells present throughout mesogloea; distally, mesogloea of scapus very thin, about twice thickness of ecto- and entoderm, but upon reaching base becoming almost five times as thick; thin ectoderm continuous, but disrupted by infiltrated particles, containing pigment cells and basophilic gland cells; thin entoderm with abundant brown granular pigment cells, basophilic gland cells, and a few holotrichs. External to the ectoderm is a very thin, loose, transparent cuticle which is lost after preservation and is not seen in sections.

CNIDOM: Holotrichs of actinopharynx, 42–44 × 18–21 μm, few; of mesenterial entoderm, 40–45 × 16–21 μm, common; of column ectoderm, 12–14 × 5–6 μm, common. Spirocysts of tentacles, 14–21 × 3–4 μm, numerous; of oral disc, 14–21 × 3–4 μm, common. Microbasic b-mastigophores of actinopharynx, 16–18 × 3–4 μm, numerous; of tentacles, 19–21 × 4 μm, few. Microbasic p-mastigophores of filaments, 16 × 4–5 μm, numerous.

Discussion.—Parazoanthus tunicans grows upon an arborescent species of hydroid (*Plumularia* sp.) and is the sole known species of the genue in the Caribbean with this habit. Only one other species, *P. dichroicus* Haddon and Shackleton (1891) from Australia, lives upon a similar hydroid. *P. tunicans* is known only from the Caribbean, having been reported from Guadeloupe, Virgin Islands, Jamaica (Duerden, 1900; Pax, 1910; Pax and Muller, 1956), and Panama (personal observation). In Puerto Rico, *P. tunicans* has been found below 18 m in depth near the edge of the insular shelf off La Parguera. It is the rarest species of *Parazoanthus* in Puerto Rico, and possibly its distribution and abundance is related to the rarity of its host.

Included in the above description are a few observations contrary to Duerden's (1900) original description of this species. Duerden stated that his specimens contained zooxanthellae, but no pigment cells, in the entoderm. The opposite was true of the Puerto Rican specimens examined. In squashed preparations, the pigment granules were observed inside slightly oval cells, and it is surmised that Duerden might have mistaken these cells for zooxanthellae. In addition, Duerden

found his specimens possessed 28–32 mesenteries, but no cuticle or thickening of the actinopharynx mesogloea in the vicinity of the siphonoglyph. Although these few differences exist, the remainder of the external and anatomical characteristics (size, color, growth form, tissue layers and structures, and geographic and bathymetric distribution) agree and the local specimens are considered to be *P. tunicans*.

The other species of *Parazoanthus* which is close to *P. tunicans* is *P. dichroicus*, the description of which is not as thorough as is desired. *P. dichroicus* contains pigment cells, but no zooxanthellae, and possesses 36 mesenteries. However, due to the great geographic separation of the two species and the lack of dichroism in the local species, *P. tunicans* is considered distinct from the Australian species, and until specimens from Australia, Jamaica, and Puerto Rico are compared a stronger statement cannot be made.

Parazoanthus swiftii (Duchassaing and Michelotti)
Figures 1 and 3

Gemmaria swiftii Duchassaing and Michelotti, 1861: 331, 332, pl. 8, figs. 17, 18.
Palythoa (str. s.) axinellae (in part) Andres, 1883: 331.
Palythoa swiftii Roule, 1900.
Parazoanthus swiftii. Duerden, 1898a: 372–375, pl. 17, fig. 11.

Material.—One sample of over 30 colonies on the sponge, *Thalysias juniperina*, from Cayo Caballo Blanco, La Parguera, collected by the author in water 6–13 m in depth on June 20, 1970. Two samples of over 50 colonies on the sponge *Iotrochota birotulata*, collected by the author on June 20, 1970, in 6–13 m of water from Cayo Enrique and from the edge of the insular shelf, La Parguera, Puerto Rico.

Diagnosis.—Colonies flat, bandlike, consisting of up to 200 polyps; scapus thick-walled, densely incrusted with white calcareous sand and sponge spicules; scapulus thin-walled, with ridges numbering to 13; tentacles and mesenteries numbering to 26; marginal sphincter muscle entodermal, weak; mesogloea of column thick, with extensive encircling sinus and numerous associated canals, cell islets, and lacunae; holotrichs of column ectoderm abundant; coenenchyme and column yellow to yellow-orange; tentacles pale yellow; sexes separate; occurring primarily on sponges *Iotrochota birotulata* and *Thalysias juniperina*.

Description.—Length and diameter of largest fully extended living polyps, respectively, 7 mm and 2.5 mm; fully retracted polyps mammiform, rising little more than 1 mm above surface of coenenchyme; clones numbering to over 200 polyps.

Color yellow to yellow-orange, due to abundance of granular pigment cells in ectoderm; tentacles and oral disc paler yellow, due to absence of highly refractory calcareous sand grains; insertions of the mesenteries visible through oral disc in some living specimens.

Coenenchyme bandlike, incrusting, most often one polyp wide, becoming expanded and sheetlike in places; interpolyp distances 1–20 mm. Colonies cover up to 75% of the surface area of *Thalysias juniperina*, on which they usually grow in straight lines. On *Iotrochota birotulata*, colonies become more meandering, branching, and sheet-like, covering up to 50% of the sponge surface area.

Scapus thick-walled, densely infiltrated with calcareous sand; scapulus shorter, thinner; scapular ridges numbering to 13 in oldest polyps, distinct in all but most retracted polyps; column infiltration of calcareous sand absent in inter-ridge depression, extending up column onto lower portions of ridges; infiltration of ridged margin mostly monaxon sponge spicules; tentacles numbering to 26, 4–5 mm in length in largest and most expanded living polyps; diameter of concave

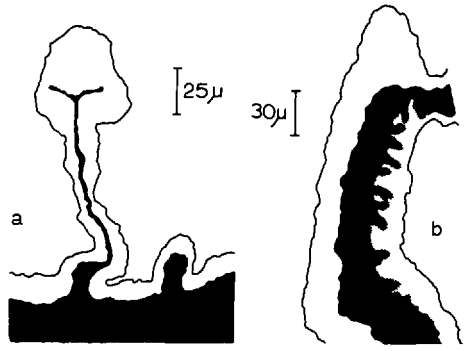

Figure 3. *Parazoanthus swiftii*: a, transverse section of a macro- and microcneme; b, transverse section of the scapular region showing the pleats of the mesogloea (black) on which the sphincter muscle fibers are borne.

oral disc half length of tentacles; expanded polyps with prominent peristomial lips and distinct siphonoglyph.

Marginal sphincter muscle (Fig. 3b) entodermal, weak, diffuse, borne on 10–15 unbranched, mesogloeal pleats, and tapering gradually below. However, where it passes through the mesogloeal lamina of a mesentery, it resembles a mesogloeal sphincter.

Mesenteries numbering to 26, 13 microcnemic and 13 macrocnemic; retractor muscles weak, consisting of thin sheath of fibers next to mesogloea; near actinopharynx, filaments trifoliate, becoming more cylindrical near base; cnidoglandular tract and ciliated tracts of filaments typical; entoderm of mesentery proper thin, with few basophilic gland cells, granular pigment cells, and no holotrichs; mesogloea very thin and homogeneously acellular; microcnemes extending approximately one-seventh as far out from column as do macrocnemes (Fig. 3a); gonads, when mature, occupying almost total width of macrocnemes between filaments and column wall and extending from base up to actinopharynx; sexes separate.

Actinopharynx corrugated longitudinally; ectoderm thick, ciliated and containing pigment and acidophilic gland cells, with basophilic gland cells and nematocysts near free surface; in section, mesogloea of actinopharynx extremely thin, thickening appreciably in region of siphonoglyph; entoderm thick and containing a few acido- and basophilic gland cells; siphonoglyph well developed, ciliated, and longer than indistinct hyposulcus.

Mesogloea of column 4–5 times as thick as ectoderm, possessing cell islets, numerous lacunae and extensive encircling sinus lined with ectodermal cells and a few holotrichs; lateral canals lined with ectodermal cells connecting sinus with ectoderm in some places; infiltration of mesogloea primarily calcareous sand grains with few sponge spicules; ectoderm abruptly and greatly varying in thickness, continuous but disrupted by infiltrated particles, and containing pigment cells, acidophilic gland cells and aggregations of holotrichs; entoderm extremely thin, with few acido- and basophilic gland cells but no nematocysts.

CNIDOM: Holotrichs of the filaments, 24 × 12 μm, few; of column ectoderm, 24 × 12 μm, common. Spirocysts of tentacles, 18–19 × 4 μm, numerous. Microbasic b-mastigophores of filaments, 15–16 × 3 μm, numerous; of tentacles, 15–16 × 3 μm, few. Microbasic p-mastigophores of actinopharynx, 15–16 × 3 μm, numerous.

Discussion.—*Parazoanthus swiftii*, the most abundant species of the genus in Puerto Rico, is most commonly found on the branching sponges *Iotrochota birotulata* and *Thalysias juniperina*. *T. juniperina*, with or without zoanthids, was not found to occur at depths greater than about 12 m. On the fringing reefs, *P. swiftii* was only rarely observed in water less than 6 m in depth, and was usually found below 10 m. Virtually no specimens of the two host sponge species were found without the zoanthid symbiont in these deeper waters.

P. swiftii has been previously reported only from the Virgin Islands and Jamaica (Duchassaing and Michelotti, 1861, 1866; Duerden, 1898a, 1898b, 1903). The local specimens differ little from published descriptions of the species. Although *P. swiftii* is reported to have a maximum of 24 tentacles and possess a thin cuticle, a few Puerto Rican specimens had 26 tentacles and none were found to have a cuticle. In addition, all previous accounts describe this species from the same black, branching sponge, which is assumed to be *I. birotulata*, and do not list any other host, such as *T. juniperina*.

Only *Parazoanthus axinellae* (Schmidt) from the Mediterranean appears sufficiently close to *P. swiftii* to warrant comparison. *P. axinellae* is also a colonial symbiont of sponges and is similar to the local species in size, color, infiltration, and in having holotrichs within its column ectoderm and cell islets. However, the European species differs in having a higher number of mesenteries and tentacles, indistinct ridges, colonies usually of four or fewer polyps, and in its habit of often occurring free. In view of these discrepancies and the geographic ranges, these two species are considered distinct.

The growth of *Parazoanthus swiftii* on *Iotrochota birotulata* represents a distinct type which is defined by the shape and growth of the host. *I. birotulata* is a thin and ramose sponge which grows almost exclusively at its apices. *P. swiftii* reproduces asexually by budding in an approximately straight line along the rami of the sponge. However, additional growth phenomena were observed over the 14-week period. Although this species usually forms long, intact clones, over a 14-week period the coenenchyme between two polyps was occasionally observed to thin out and disappear, separating the two parts of the colony. Although most budding is at the ends of the colonies, an occasional polyp arose from the coenenchyme. Some polyps arose *de novo* on bare areas, indicating larval settling. The other host of *P. swiftii*, *Thalysias juniperina*, is pink to red in color and is also a thin ramose sponge. It seems likely that growth of the zoanthids on this sponge is similar to that just described for *I. birotulata*. Colonies of *P. swiftii* are arranged in no apparent pattern on either host sponge.

Parazoanthus catenularis (Duchassaing and Michelotti)
Figures 1 and 4

Bergia catenularis Duchassaing and Michelotti, 1861: 330, pl. 8 fig. 12.
Bergia via lactea Duchassaing and Michelotti, 1861: 330.
Parazoanthus monostichus Duerden, 1900: 202–206, pl. 10, fig. 14; pl. 13, fig. 9.
Parazoanthus catenularis, Duerden, 1903: 496–499, pls. 44, 47.

Material.—Over 100 colonies on the flabellate sponge *Xestospongia* sp. Additional specimens on the vasiform sponge *Xestospongia muta* were observed grossly but not histologically. All specimens were collected from deeper than 18 m near the edge of the insular shelf off La Parguera, Puerto Rico, by the author, December 1970.

Diagnosis.—Colonies consisting of 1–10 polyps arranged in single linear rows; coenenchyme no wider than diameter of polyps, thin, flush with surface of sponge; scapus thin-walled, ectoderm and mesogloea infiltrated with sponge spicules and white calcareous sand grains; scapulus thin-walled, infiltrated below,

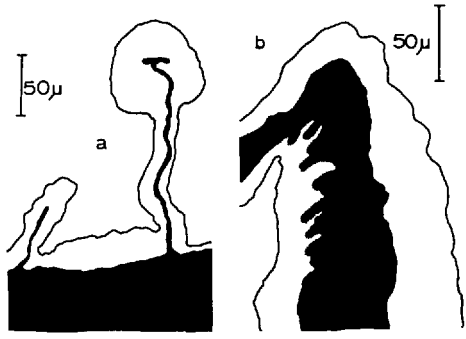

Figure 4. *Parazoanthus catenularis*: a, transverse section of a macro- and microcneme; b, transverse section of the scapular region showing the pleats of the mesogloea (black) on which the sphincter muscle fibers are borne.

ridges numbering to 10; tentacles and mesenteries numbering to 20; marginal sphincter muscle entodermal, diffuse, weak, and borne on 7–10 simple pleats; mesogloea of column thin, with encircling sinus, a few lacunae, cell islets containing eosin-staining gland cells and zooxanthellae; entoderm of column and tentacles with abundant zooxanthellae; holotrichs of column ectoderm common in scapulus and upper scapus; coenenchyme and column white to greyish white; tentacles brown to yellow-brown.

Description.—Length and diameter of extended living polyps rarely more than 1 mm; fully retracted polyps rising little from surface of coenenchyme; polyps numbering to 10 per clone.

Color of column and coenenchyme white to greyish white, due to infiltration of calcareous sand; tentacles brown to yellow-brown, concave oral disc darker brown, peristomial lips yet darker brown; mouth appearing as light colored slit; insertions of mesenteries visible through oral disc in most specimens.

Coenenchyme constricted between polyps, giving the catenulate appearance; clones running in straight or slightly curved lines, with occasional lateral branch; clones of 1–2 polyps common; inter-polyp distances within clones 1–4 mm.

Polyps incapable of complete retraction; scapular ridges numbering to 10, usually distinct; calcareous sand infiltration of column extending up onto scapular ridges, but lacking in inter-ridge depressions; infiltrated sponge spicules most concentrated on scapus, but also present throughout mesogloea of column; tentacles in two cycles, numbering to 20, and 1 mm in length in largest living polyps; peristomial lips prominent, rising considerably above surface of oral disc; siphonoglyph indistinct.

Marginal sphincter muscle (Fig. 4b) entodermal, diffuse, weak, and tapering at its margins; muscle fibers borne on 7–10 unbranched, thin mesogloeal pleats.

Mesenteries (Fig. 4a) numbering to 20 with 10 macrocnemes and 10 microcnemes; retractor muscles feeble, fibers borne on low mesogloeal pleats; parietobasilar musculature similarly weak; in region of actinopharynx, filaments not typically trifoliate; glandular tract with abundance of basophilic gland cells, nematocysts, and ciliated cells; underdeveloped lateral ciliated tracts with acido- and basophilic glands and nematocysts; mesogloea for the greater part thin, thickening at column wall; entoderm with zooxanthellae, but lacking holotrichs. All specimens examined lacked discernible gonads.

Actinopharynx smooth, its ectoderm containing nematocysts and acido- and

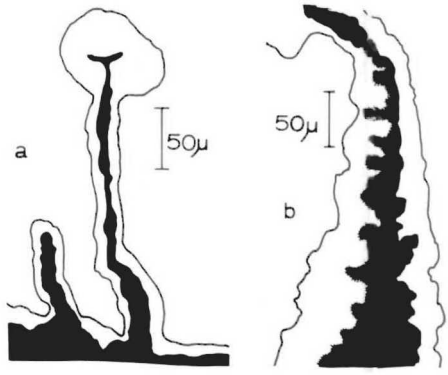

Figure 5. *Parazoanthus parasiticus*: a, transverse section of a macro- and microcneme; b, transverse section of the scapular region showing the pleats of the mesogloea (black) on which the sphincter muscle fibers are borne.

basophilic granular gland cells; siphonoglyph very shallow and ciliated; mesogloea very thin, thickening slightly in region of siphonoglyph; entoderm with extraordinary number of zooxanthellae and few basophilic gland cells.

Column mesogloea acellular and nonfibrous; mesogloea of scapus as thin as or thinner than ectoderm, densely infiltrated with sponge spicules; encircling sinus lying close to entoderm and not always continuous nor distinct; mesogloea thickening near scapulus, containing numerous cell islets, cords of zooxanthellae, and acidophilic gland cells; mesogloea of scapulus again narrowing, containing extraordinary number of sponge spicules; internal limitations of ectoderm irregular; ectoderm disrupted although continuous, owing to the numerous incrustations; entoderm of scapus as thick as other two tissue layers, with abundant zooxanthellae; entoderm of scapulus thinner, containing acido- and basophilic gland cells as well as abundant symbiotic algae.

CNIDOM: Holotrichs of tentacles, 25–28 × 10–13 μm, few; of column ectoderm, 30 × 14 μm, common. Spirocysts of tentacles, 13–18 × 3–5 μm, numerous. Microbasic b-mastigophores of actinopharynx, 12–14 × 3 μm, numerous. Microbasic p-mastigophores of filaments, 16–17 × 4 μm, numerous.

Discussion.—Parazoanthus catenularis is most commonly found on the maroon flabellate sponge, *Xestospongia* sp., but also occurs frequently on the large maroon, vasiform species, *X. muta*. None of these sponges has been found in water less than 13 m deep, and they are most abundant near the edge of the insular shelf as deep as the author has been able to observe them (65 m). No specimens have been seen on the inner fringing reefs of La Parguera. The flabellate *Xestospongia* is more common than *X. muta* and almost always has symbiotic zoanthids living on it. It is interesting to note that the former sponge is the only one known at present upon which two distinct species of sponge-inhabiting zoanthids (in this case, *P. catenularis* and *Epizoanthus cutressi*) live side by side.

P. catenularis has been previously reported from the Antilles and Jamaica (Duchassaing and Michelotti, 1861, 1866; Duerden, 1898b, 1900, 1903). The best previous examination and description of this species is that of Duerden (1900) under the synonym *P. monostichus*. The local specimens, except for lacking a cuticle, compare almost precisely with Duerden's description. The availability of abundant, well preserved specimens has made it possible to more fully describe the species.

Growth observations showed that, although *P. catenularis* was most commonly observed on its maroon host, *Xestospongia* sp., in groups of 1–10 polyps connected by a narrow coenenchyme, it initially propagated in near straight or slightly curved lines of well over 10 polyps. At this young stage, the interpolyp coenenchyme was as wide as that surrounding the individual polyps. Within a few weeks time, individual polyps or small groups of polyps became separated as the interpolyp coenenchyme narrowed and disappeared. This breaking up of colonies continued, along with additional budding, until the sponge surface was almost totally covered with isolated polyps and small groups of 2–3 polyps. No polyps resulting from settlement of planulae were observed.

Parazoanthus parasiticus (Duchassaing and Michelotii)
Figs. 1 and 5

Zoanthus parasiticus Duchassaing and Michelotti, 1861: 326, pl. 8, figs. 3, 4.
Parazoanthus parasiticus, Verrill, 1900: 560–561.
Parazoanthus separatus, Duerden, 1900: 197–202, pl. 10, figs. 12–13; pl. 13, fig. 3; pl. 14, fig. 4.

Material.—One lot of over 100 polyps on a sample of the sponge, *Spheciospongia* sp., collected by the author December 1970, at a depth of 33 m from near the edge of the insular shelf off La Parguera, Puerto Rico. Additional specimens were collected from 25 m on the brown boring sponge, *Cliona* sp., from the same location, December 1970. Other specimens were collected from Cayos Caballo Blanco and Enrique in 10 m of depth, July 20, 1971, on the sponges *Gelliodes ramosa* and *Callyspongia vaginalis*.

Diagnosis.—Colonies of 1–2 polyps on flat surfaces of sponges, *Cliona* spp., *Callyspongia vaginalis*, and *Spheciospongia* sp., and in inter-conule depressions of sponge, *Gelliodes ramosa*; coenenchyme surrounding each polyp thin, narrow; scapus thick-walled, its mesogloea and ectoderm densely infiltrated with white calcareous sand grains and a few sponge spicules; scapulus thin-walled, ridges numbering to 14; tentacles and mesenteries numbering to 28; marginal sphincter muscle entodermal, weak, diffuse; mesogloea of column thick with numerous cell islets, lacunae, and discontinuous encircling sinus; holotrichs of ectoderm and cell islets abundant; coenenchyme and column white, tentacles brown.

Description.—Length and diameter of largest living and expanded polyps usually 1 and 1.5 mm, respectively; completely retracted polyps mammiform, rising little above surface of coenenchyme; diameter of coenenchyme surrounding polyps seldom more than 2 mm; number of polyps on a sponge limited only by host surface area; polyps usually occurring singly or occasionally in groups of 2–3.

Column and coenenchyme white to greyish-white owing to white calcareous infiltration; tentacles brown to yellow-brown in color, due to numerous zooxanthellae; oral disc a darker brown than tentacles; peristomial lips off-white.

Scapus infiltrated, thick-walled, with the ridges numbering to 14; infiltrations in scapulus mostly sponge spicules in mesogloea; calcareous sand infiltration of column extending onto marginal ridges; inter-ridge depressions devoid of infiltrated particles; tentacles blunt, numbering to 28, up to 0.5-mm long on living polyps; peristomial lips raised, prominent on well expanded polyps.

Marginal sphincter muscle tapering very gradually below, entodermal, weak, consisting of 9–11 unbranched pleats, and better developed in some specimens than in others (Fig. 5b).

Mesenteries number to 28, 14 macrocnemic and 14 microcnemic; retractor muscles extremely weak, discernible as a sheath one fiber thick against mesogloea; parietobasilar muscles are weak and barely discernible; mesenterial filaments at mid-column trifoliate, with nematocysts and basophilic glands within

cnido-glandular tract and with numerous basophilic gland cells and a few acidophilic gland cells and zooxanthellae in the two lateral ciliated tracts; entoderm of mesenteries proper containing zooxanthellae and basophilic glands; without holotrichs in entoderm; mesenterial mesogloea thin, widening at insertions of mesenteries into column wall, and containing no cell enclosures; microcnemes extending approximately one-quarter as far out from column wall as do macrocnemes (Fig. 5a), similar to parietal portions of macrocnemes; gonads borne near free edge of macrocnemes; sexes separate.

Actinopharynx usually with a few longitudinal corrugations, although not evident in some specimens; siphonoglyph ciliated and with basophilic gland cells; ectoderm containing numerous nematocysts, basophilic gland cells, and a few acidophilic gland cells; mesogloea thin (approximately one-half thickness of entoderm), becoming 2–3 times as thick in vicinity of siphonoglyph; ciliated siphonoglyph well developed; hyposulcus indistinct and shorter than siphonoglyph.

Mesogloea of scapus thick, cellular, and containing abundance of cell islets, lacunae left by dissolved sand grains, ectodermal cords, and indistinct and discontinuous encircling sinus; islets and sinus lined with cells characteristic of ectoderm, i.e., acido- and basophilic gland cells and holotrichs, in some areas so numerous as to give mesogloea a cellular appearance; in scapular region, mesogloea narrows, containing a concentration of monaxon spicules; ectoderm continuous but interrupted by infiltrated particles, containing acidophilic gland cells, occasional holotrichs, and numerous transparent cells with pycnotic nuclei; ectoderm rarely more than one-third as thick as mesogloea, with irregular internal limitations; entoderm one-fifth as thick as mesogloea, with numerous zooxanthellae and a few basophilic gland cells.

CNIDOM: Holotrichs of column ectoderm and entoderm, 20–23 × 10–12 μm, common. Spirocysts of tentacles, 15–19 × 4–5 μm, numerous; of mesenterial filaments, 15–19 × 4–5 μm, few. Microbasic b-mastigophores of tentacles, 15–17 × 3–4 μm, few; of ectoderm of actinopharynx, 13–14 × 3 μm, numerous. Microbasic p-mastigophores of mesenterial filaments, 17–19 × 4 μm, numerous.

Discussion.—Parazoanthus parasiticus has been found living on four species of sponges in Puerto Rico. On the inner fringing reefs of La Parguera, *P. parasiticus* is most common on *Gelliodes ramosa* which is seldom observed below 3 m without the zoanthid. Less often, *P. parasiticus* is found on the common tan sponge, *Callyspongia vaginalis,* below 3 m on the same reefs. In deeper water (20–30 m) near the edge of the insular shelf, this species is most common on the brown boring sponge, *Cliona* sp. However, it is also found here occasionally dwelling on *G. ramosa* and and a massive sponge, *Spheciospongia* sp.

P. parasiticus has the greatest range for West Indian species of the genus, having been previously reported from the Virgin Islands, Bermuda, Jamaica, and the Bahamas (Duchassaing and Michelotti, 1861; Verrill, 1900; Duerden, 1900, 1903) and seen by this author in Atlantic Panama. This zoanthid was found living on *Callyspongia vaginalis* (=*Spinosella vaginalis*) in all these reports except one (Duerden, 1900) where it was found on a large, black, massive sponge from Jamaica, probably *Spheciospongia vesparia.*

The most thorough investigation of this species published is that of Duerden (1900) under the name *P. separatus.* Duerden later (1903) synonymized this with *P. parasiticus.* The present description is in agreement with Duerden's except for the number of scapular ridges, tentacles, and mesenteries in the largest specimens. Duerden reported that in his largest specimens these numbered 12, 24, 24, respectively. In this study, some specimens examined agreed with Duerden's,

but ridges, tentacles, and mesenteries of most polyps numbered 14, 28, 28. In light of this variability, these differences appear of no consequence.

P. parasiticus was observed for growth characteristics on two different species of sponges, the massive *Spheciospongia* sp., and the coral boring *Cliona* sp. These two species are of different growth forms; the former grows more or less three dimensionally, while the latter grows two dimensionally. Neither sponge displayed any independent polyps from settled larvae. Zoanthid growth on both sponges was identical in all respects. No groups of connected polyps numbered more than three, and groups this size were scarce. Reproduction was by budding. After a variable time, the new polyps reached the size of their "parent" and broke away. After breaking away, the polyps changed positions constantly in no apparent pattern. However, in areas with a high density of polyps, little change of position was observed. It is not known whether polyp positional changes were due to active movement of the polyps over the sponge surface or to sponge growth between polyps. The isolated polyps of *P. parasiticus* were arranged with considerable regularity over the most densely populated areas of the sponge. Such polyps were usually separated one from another by two or three polyp diameters.

Parazoanthus puertoricense new species
Figures 1 and 6

Material.—Lots of over 100 polyps from two species of *Agelas* and two undescribed sponge species, collected near the edge of the insular shelf off La Parguera, Puerto Rico, in water over 18 m in depth, by the author, December 1970.

Holotype, one lot living on an undescribed cream-colored sponge, referred to here as sponge "x," collected by the author, December 1970, at a depth of 20 m, 10 km south of La Parguera, Puerto Rico, USNM 56826.

Diagnosis.—Colonies of 1–3 connected polyps living on surface of sponges, *Agelas* spp., cream-colored flat sponge "x," and massive maroon sponge "z"; coenenchyme surrounding each polyp thin, narrow, and infiltrated with calcareous sand grains and sponge spicules; scapus thick-walled, mesogloea and interior portion of ectoderm densely infiltrated with sponge spicules and some calcareous sand grains; scapulus thin-walled, clean, ridges numbering to 12; tentacles and mesenteries numbering to 24; marginal sphincter muscle entodermal, weak, diffuse, and simply pleated; mesogloea of column thick with extensive encircling sinus, cell islets, and lacunae; holotrichs of ectoderm numerous; coenenchyme, column, tentacles, and oral disc maroon or burgundy in coloration.

Description.—Expanded, living polyps of *Parazoanthus puertoricense* seldom more than 1 mm in height and 1.5 mm in diameter; completely retracted polyps mammiform, rising little above surface of coenenchyme; width of coenenchyme surrounding polyps rarely more than 2 mm.

Abundant pigmentation in all cell layers, imparting to living animal an overall dark maroon color; dense concentrations of sponge spicules and calcareous sand grains limited to mesogloea and inner ectoderm, a white color becoming apparent only after the ectoderm has been rubbed off; fully expanded tentacles paler than dark oral disc on which peristomial lips are not easily distinguishable.

Polyps distributed with considerable regularity over sponge surfaces, except on *Agelas* spp., where less dense; occasionally, two or more polyps united as result of asexual reproduction by budding, eventually separating.

Ridges of scapulus numbering to 12 in largest specimens, distinct in all except completely retracted polyps; calcareous sand infiltration of column extending up

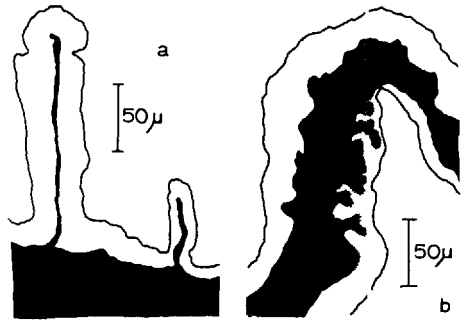

Figure 6. *Parazoanthus puertoricense*: a, transverse section of i. macro- and microcneme; b, transverse section of the scapular region showing the pleats of the mesogloea (black) on which the sphincter muscle fibers are borne.

to base of ridges, stopping abruptly; infiltration in scapulus consisting of abundance of monaxon sponge spicules in mesogloea; tentacles in two cycles, numbering to 24, up to 1 mm in length in largest living, expanded polyps; peristomial lips rising slightly above surface of oral disc.

Marginal sphincter (Fig. 6b) entodermal, weak, diffuse, stopping abruptly below; muscle fibers borne on 6–8 branched mesogloeal pleats.

Mesenteries numbering to 24, 12 macrocnemic and 12 microcnemic; weak retractor muscles consisting of thin sheath of fibers against mesogloea; parietobasilar muscles better developed and consisting of fibers borne on pleats or folds; at level of actinopharynx, macrocnemes extremely thin and in some cases microcnemes barely discernible; filaments never truly trifoliate but rather cylindrical with ciliated and cnido-glandular tracts, as separate entities, less distinct than in most other species of *Parazoanthus*; filaments containing nematocysts, basophilic gland cells, a few acidophilic gland cells, and a few pigment cells; mesogloea of mesenteries at mid-column very thin but slightly swollen at origin in column wall; entoderm 5–7 times as thick as mesogloea, containing pigment cells, a few acidophilic gland cells, and numerous neutrophilic cells with strongly staining nuclei; microcnemes rarely extending out from column wall more than one-third as far as macrocnemes and, in many cases, scarcely extending beyond column entoderm (Fig. 6a); gonads indiscernible in holotype, but other polyps containing ovaries with ripe ova.

Actinopharynx smooth; ectoderm containing nematocysts, pigment cells, basophilic gland cells, and large prominently nucleated neutrophilic cells; mesogloea thin, widening in region of siphonoglyph; entoderm containing pigment cells and large neutrophilic cells; siphonoglyph well developed and longer than indistinct hyposulcus.

Column divided into thick-walled scapus and short thin-walled scapulus; acellular mesogloea of scapus with abundant cell islets, lacunae, and monaxon sponge spicules; encircling sinus extensive in some specimens but discontinuous and indistinct in others due to dense infiltration of spicules; cell islets, canals, and sinuses lined with pigment cells and neutrophilic cells with pycnotic nuclei; ectoderm about one-third the thickness of mesogloea, twice that of entoderm, and containing abundant holotrichs; internal limitation of continuous ectoderm often irregular, owing to density of infiltrated particles; thin entoderm containing numerous pigment cells but no nematocysts; cell layers becoming thinner in scapulus although mesogloea with almost as many sponge spicules as elsewhere.

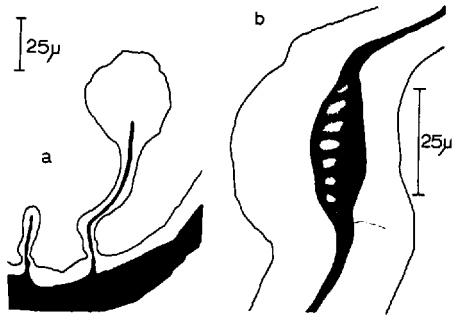

Figure 7. *Epizoanthus cutressi*: a, transverse section of a macro- and microcneme; b, transverse section of the scapular region showing the lacunae in the mesogloea (black) on which the sphincter muscle fibers are borne.

CNIDOM: Holotrichs of tentacles, 22 × 12 μm, few; of the column ectoderm, 19–23 × 11–13 μm, common. Spirocysts of tentacles, 15–18 × 3–4 μm, numerous. Microbasic b-mastigophores of tentacles, 13–14 × 2–3 μm, few; of actinopharynx, 12–13 × 2–3 μm, numerous. Microbasic p-mastigophores of filaments, 12–13 × 2–3 μm, numerous.

Discussion.—Parazoanthus puertoricense is the commonest species of the genus found at depths of 20–30 m near the edge of the insular shelf, 10 km off La Parguera. A tubular tan sponge, *Agelas* sp. is the commonest host species and nearly all observed specimens were covered with this zoanthid. Fifty to 75% of the less common sponges, an orange *Agelas* and sponge "z," possess the zoanthid symbiont. The least common host is sponge "x," of which only one specimen has been found. None of these sponges, nor any other species with *P. puertoricense* has been found on the fringing coral reefs off La Parguera. In Jamaica, the author has observed the new species on an additional host sponge, *Stromatospongia vermicola*.

The prime feature of *P. puertoricense* which separates it from other West Indian members of the genus is its dark maroon coloration. As is found in *P. parasiticus*, polyps of *P. puertoricense* possess a thin and narrow coenenchyme and are predominantly isolated from other polyps in the colony, but in the former species the mesenteries are usually 28, rather than 24 as in the latter. In addition, the column mesogloea of the former contains numerous holotrichs in the cell islets and only a few included sponge spicules, whereas that of *P. puertoricense* contains no nematocysts and is heavily infiltrated with sponge spicules. In view of these features, *P. puertoricense* is considered a new species.

The growth of *Parazoanthus puertoricense* was also documented over a 14 week period on two distinct species of sponge (*Agelas* sp. and sponge "z"). For those clones on the first species, no change was found in the positions or numbers of polyps. On sponge "z," however, a considerable amount of growth was recorded. Asexually, new polyps arose from the coenenchyme surrounding the "parent" polyps. As the new polyps increased in size, they moved away from the "parents," the connecting coenenchyme becoming thinner. When they became separated by 3–5 polyp diameters, the coenenchyme disintegrated and disappeared. The spatial distribution of *P. puertoricense* on sponge "z" is remarkably regular, the isolated polyps being 3–5 polyp diameters apart. On *Agelas* spp., polyps are often in groups of three or four and are distributed over the sponge surface without much regularity.

Family Epizoanthidae Delage and Hercouard, 1901: 664

Zoanthidea with the primitive pairs of mesenteries each with one macrocneme and one microcneme. Marginal sphincter muscle mesogloeal.

Epizoanthus Gray, 1867: 237

Type-species.—By monotypy: *Duseideia? papillosa* Johnston, 1842: 190, 251 (in part), text fig. 18 (not pl. 16, figs. 6, 7), = *Epizoanthus incrustatus* (Duben and Koren, 1847): 268. Gender: neuter.

Diagnosis.—Epizoanthidae with a single marginal sphincter muscle in the mesogloea; scapus and coenenchyme infiltrated with foreign material; ectoderm usually continuous but may occasionally be discontinuous; mesogloea often with cell islets and lacunae; polyps either colonial or solitary; coenenchyme bandlike, incrusting or greatly reduced in solitary forms; dioecious. (Diagnosis essentially that of Cutress and Pequegnat, 1960.)

Number of Species.—One species of *Epizoanthus* was found in the coastal waters of Puerto Rico. This species is undescribed and lives on one species of sponge.

Epizoanthus cutressi new species
Figures 1 and 7

Material.—Holotype, colony of over 1,000 polyps on *Xestospongia* sp. from 10 km south of La Parguera, Puerto Rico, at a depth of 26 m near the edge of the insular shelf, collected by the author, June 20, 1971, USNM 56827.

Diagnosis.—Colonies embedded in sponge, *Xestospongia* sp., with only scapus of polyps projecting from surface; diameter and height of extended living polyps, respectively, 0.3 and 1 mm; connecting coenenchyme stolon-like and usually beneath the sponge surface; scapulus thin-walled, clean; scapular ridges numbering to 12, distinct; tentacles and mesenteries numbering to 12; marginal sphincter mesogloeal, weak; mesogloea of column thin, with no cell islets, lacunae, or sinuses; holotrichs of column and tentacles with zooxanthellae; coenenchyme, column, and tentacles yellow.

Description.—Length and diameter of largest fully expanded living polyps, respectively, 1.0 and 0.3 mm; retracted polyps only slightly shorter, as only scapulus closed, appearing mammiform in slight depressions on sponge surface; length of tentacles in expanded living specimens is 0.5–0.7 mm; colonies usually covering entire surface of sponge and spaced with considerable regularity.

Color of polyps and coenenchyme yellow; insertions of mesenteries visible through oral disc; oral disc slightly darker yellow than tentacles and prominent lips; coloration due to abundant zooxanthellae in entoderm of tentacles, disc and column.

Newly budded polyps possessing extremely narrow coenenchyme surrounding base; older polyps lengthening and moving apart, coenenchyme assuming stolon-like nature submerged in host sponge; oldest colonies distributed quite regularly over entire surface of host sponge; inter-polyp distance usually less than 1 mm.

Scapus thin-walled and incrusted with sponge spicules; much shorter scapulus slightly thicker than scapus and bearing up to 12 distinct ridges; convex oral disc up to 0.25 mm in diameter, with protruding mouth lacking a prominent siphonoglyph.

Marginal sphincter muscle (Fig. 7b) mesogloeal, weak, diffuse, broadest in upper part and tapering abruptly below; muscle fibers borne on 8–9 stratified lacunae.

Mesenteries numbering to 12 in largest specimens, six macrocnemic and six microcnemic; musculature of mesenteries indiscernible but if present probably extremely weak as polyp column retracts only slightly; mesenterial filaments ciliated and only slightly trifoliate near actinopharynx but more cylindrical below; glandular tracts of filaments containing numerous nematocysts and acido- and basophilic gland cells; entoderm of mesenteries containing zooxanthellae, baso- and acidophilic gland cells and a few holotrichs, thin in region of actinopharynx, and thickening appreciably below; mesogloea of mesenteries extremely thin, acellular, and containing no cell islets; microcnemes extending out from column one-third to one-half as far as macrocnemes, of same nature as that portion of macrocnemes nearest column wall (Fig. 7a); polyps from type colony possessing ripe ova.

Actinopharynx smooth and possessing thick ectoderm with numerous nematocysts and basophilic gland cells in basic-staining acellular matrix; siphonoglyph indistinct, consisting only of few ciliated cells along one side of pharynx; hyposulcus indistinct and extending no further than sulcus; mesogloea of actinopharynx acellular and one-tenth as thick as ectoderm; entoderm one-fourth thickness of ectoderm and containing a few zooxanthellae.

In column, mesogloea acellular, non-fibrous, thin, and containing no cell islets or sinuses; that of scapus thickening slightly in region of sphincter muscle; ectoderm five times as thick as mesogloea, continuous but disrupted by incrustations, and containing a few holotrichs and acidophilic gland cells; entoderm of column as thick as ectoderm and containing abundance of zooxanthellae and a few holotrichs.

CNIDOM: Holotrichs of tentacles, 20–24 × 10–12 μm, few; of entoderm of mesenteries and column, 20–24 × 10–12 μm, common; of column ectoderm, 20–24 × 10–12 μm, common. Spirocysts of tentacles, 15–16 × 3–4 μm, few; of actinopharynx, 12–14 × 3–4 μm, numerous. Microbasic p-mastigophores of filaments, 17–18 × 5–6 μm, numerous.

Discussion.—Only one species of sponge-inhabiting *Epizoanthus* has been described from shallow water. This species, *E. sabulosum* Cutress (1971) is from Australia and is considerably larger than the new species.

Epizoanthus cutressi is unique in several respects. It is the smallest zoantharian known. Possibly related to its small size is the reduction of numbers of tentacles and mesenteries to the primary 12. The large holotrichs, in section, are seen projecting out of the extremely thin column ectoderm, as the length of the nematocysts is greater than the thickness of that tissue layer. Also peculiar is the fact that the number of scapular ridges equals that of the tentacles and mesenteries. The usual number of ridges in zoanthids is one-half that of the mesenteries and tentacles. Another unique character of this zoanthid is its colony form. No other colonial zoanthid displays its thin and stolon-like connecting coenenchyme or the submergence of such under the sponge surface; nor are the polyps of any other species embedded in the sponge to the scapular margin. Furthermore, this species is not only more host specific (living only on one species of *Xestospongia*) than any other West Indian zoanthid but also constitutes with *Parazoanthus catenularis* the only reported case of two distinct zoanthid species living together on the same sponge.

Epizoanthus cutressi increases its colony size by budding new polyps off the ends of near straight clones, one polyp wide. The youngest polyps possessed an extremely thin coenenchyme surrounding each polyp. As the polyps became older, they separated by 2–3 polyp diameters, retaining the stolon-like connecting

coenenchyme. Simultaneously, the coenenchyme surrounding each polyp was absorbed as the polyp became longer. The scapulus remained at the surface of the sponge, but the base sank deeper into the sponge as the polyp lengthened. In older polyps, the stolon-like coenenchyme connecting the bases of the polyps was not visible and these polyps appeared isolated. In areas covered with older polyps, their spatial distribution is very regular, with inter-polyp distances of 2–3 polyp diameters. One colony was observed starting independently, evidently from a settled larva.

Interspecific interaction between *Epizoanthus cutressi* and *Parazoanthus catenularis* was manifested by the near perfect segregation of the two species. For the purpose of observing the various interactions of these two species, one station with both species on one sponge was documented. Two seemingly contradictory phenomena were observed. First, a growing colony of *P. catenularis* was seen penetrating the area populated by *E. cutressi*. Within the 14-week period, this line of polyps almost reached the other side of the *Epizoanthus* colony. Within 3 mm on each side of the growing colony, polyps of *E. cutressi* had either receded or died. From this observation, it would appear that *P. catenularis* expresses dominance over *E. cutressi* in competition for substrate. However, at the boundary between colonies of the two zoanthids, the opposite conclusion could be made. Here, the polyps of *E. cutressi* were observed as a "front" advancing against the polyps of *P. catenularis*. Within the 14-week period, the boundary had moved almost 2 cm into the colonies of the latter. This latter phenomenon appeared to be the one affecting the greater exchange of substrate occupied by the two species, but further observation is necessary to establish whether it is the rule.

This new species of *Epizoanthus* is named *E. cutressi* to honor Charles E. Cutress for his efforts in zoantharian systematic biology.

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